Assessment of Geotechnical Engineering Software for Microcomputers.

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SUMMARY

This report was undertaken to assist the Alabama Highway Department Bureau of Materials and Tests ascertain what microcomputer geotechnical engineering software is available. Of the different types available, one type (consolidation) software was selected by the Division for evaluation. Five of the most promising consolidation programs were selected for evaluation. The programs were then assembled, run, and evaluated. VSTRESS3, from Acumen Software was selected as the most desirable program, and was subsequently purchased.

Introduction.

This project compiles a list of geotechnical engineering software, and examines five soil consolidation computer programs.

Microcomputer software has provided an expeditious way to perform many engineering calculations. The speed of the microcomputer often offers a substantial reduction in time to perform engineering tasks. This review allows the reader to examine the variety of programs available, as well as review the consolidation programs in depth.

VSTRESS3, from Acumen Software, offers the practicing engineer the most utility of any of the programs investigated.

Objectives of the Project.

There are two objectives of this project, viz.

1. To compile a list of all geotechnical software available for microcomputers. A summary of the characteristics of each package is compiled.

2. To identify, from the above list, a sub-list of geotechnical software functions that have immediate application in the Alabama Highway Department. The most promising geotechnical software packages that perform these functions will be examined in detail.

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Software compilation.

The first objective was to compile a list of all geotechnical engineering software currently available (1988). This task was performed by reviewing current civil engineering and geotechnical journals for advertisements, as well as contacting professional organizations. The resulting list, given in the appendix, includes programs in the following categories:

- settlement,
- database,
- groundwater,
- laboratory data reduction,
- pile analysis and design,
- retaining wall analysis and design,
- slope stability,
- dynamic analysis of dams and soil-structure interaction, and
- multi-purpose packages that incorporate several of the above functions.

The list included single purpose programs, and did not include general purpose finite element programs.

The list of programs in the appendix is necessarily timely. The engineering software market, being small, is quite volatile.

Review of software.

After the list of software was compiled, the Alabama Highway Department Bureau of Materials and Tests was contacted to select a class of software for evaluation. After consultation with the geotechnical engineers, soil consolidation was selected. Consolidation is a special case of the settlement programs, involving the compression of saturated clays under load.

Consolidation software package selection. Five software packages were chosen for evaluation -

PROGRS-1, sold by Geocomp Corp.
66 Commonwealth
Sudbury, MA 01742
(508) 369-8304

GEOTEK, formerly available from Kingman-Block Publishing Co.
now available from Prof. A. Al-Khafaji
Civil Engineering Department
Bradley University
Peoria, IL

VSTRESS3, sold by Acumen Software Products
P.O. Box 23171
Harahan, LA 70123

SETTL/G, sold by Geosoft
1442 Lincoln Avenue
Orange, CA 92665
(714) 998-4030

TCON, sold by Design Professionals Management Systems
P.O. Box 2364
Kirkland, WA 98083
(206) 822-2872

Selection of these five was based on the program description given in advertisements and in program literature. All program were IBM-PC compatible.

Consolidation software package evaluation. Program evaluation was divided into five categories. They were:

1. program use,
2. compatibility,
3. documentation evaluation,
4. program features,
5. vendor support evaluation.

Each program was specifically evaluated on each of the above criteria. An overview of each program's features is then presented.

Program use. The programs had two methods of data input. GEOTEK and VSTRESS3 used interactive input. PROGRS-1, TCON and SETTL/G ran in batch mode. However, SETTL/G came with a useful interactive input utility that made creation of the data file easy. TCON advertised an input utility, but none was included with the copy sent to the author. PROGRS-1, TCON and SETTL/G accept data files created in ASCII word processors. VSTRESS3 has an exceptionally well laid-out menu system for data input. The menu is easy to read and intuitive, allowing user input of loads, soil conditions, data storage, retrieval and modification. The data could be modified directly in the program, or edited in a file. GEOTEK has a similar menu system, although not as versatile in correcting data sets. Neither has the ability to use an existing ASCII file. All programs except GEOTEK allowed the data file to be modified and stored for sensitivity studies. Once the data file was created, the program could be run from the same menu.

Data sets for PROGRS-1 could only be created and edited using an editor external to the program. Moreover, the PROGRS-1 data sets were the much older and more cumbersome formatted type, a vestige of the old FORTRAN program PROGRS-1 was created from. Once the data file was created, the programs were run from the DOS prompt.

Compatibility. All of the programs were compatible with the IBM PC with 256k memory and a monochrome monitor. All indicated support for EGA graphics. None experienced any problem using IBM CGA graphics. The programs did not exhibit any incompatibilities with the use of the Intel 80286 chip. All programs ran with or without the math co-processor chip, although the documentation for each indicated that execution speed was greatly enhanced with this chip.

All of the programs could be run on a dual floppy disk drive system or a hard disk system. The hard disk system resulted in noticeably faster execution. The hard disk is recommended to expedite the graphics available with some of the programs.

Documentation of output devices varied greatly. Geosoft's SETTL/G explicitly supported many printers (including laser printers) and many plotters (including the HP7475, which is very popular). PROGRS-1 comes with an independent Geocomp graphics utility that supports several printers and plotters. VSTRESS3 did not provide a list of any printers supported. The program ran on an Epson printer, and is expected to run on Epson-compatible printers. The color graphics was supported by dot-density on dot matrix printers. Output was primarily by screen dumping (a screen dump utility was recommended). Neither GEOTEK documentation nor software indicated any output devices. However, screen dumps of plots and tables printed on an Epson graphics printer were suitable. TCON did not explicitly indicate compatibility with any output devices, but notes that the plotting files created by the program are in the Hewlett-Packard Graphics Language.

Documentation evaluation. Instructions came with each program, describing program installation and operation. Each required the user to be knowledgeable about soil consolidation. Each is described below.

The best documentation came with the VSTRESS3 program. The program, menu-driven, was almost entirely self-descriptive. It required very little reference to the written manual (provided on a floppy disk). The menus described program functions clearly, and described the input variables clearly. The input prompts did not indicate units to use, however, the manual clearly indicated that any consistent input units could be used. This made it easy to become proficient on VSTRESS3.

The GEOTEK program is documented by a large manual describing all the programs that are part of the GEOTEK package. The consolidation program documentation was helpful, but not complete. The on-line documentation (the prompts for data) was also incomplete. The example problems did not have the proper units on the input to produce meaningful output. None of the input prompts indicated the proper units to use. After conversation with the current vendor, it was learned that any consistent input units could be used (contrary to the example problems in the manual). The menu system was easy to use, although slow.

The PROGRS-1 manual provided the only source of explanation. This manual was taken *in toto* from the original documentation for the mainframe version of the program. The description of the input variables is cryptic, at best. Unless the user is intimately familiar with the algorithm used, it is difficult to interpret the meaning of the input variables. There is no menu support for input, making the user reliant on the manual.

SETTL/G was well documented. SETTL/G was the only program that used units on the input prompts. U.S. customary units were allowed in the current version. A version using S.I. units is available. The pleasant menu system was complimented by a well organized readable manual. This program allowed the user to create the data file with an editor, or to use a utility provided with the program. The input utility was straightforward and logical. The utility made it easy to correct input, or edit existing input files.

TCON came with the most extensive theoretical documentation. Most of the 50 page manual was devoted to the underlying principles on which the program is based. The remainder is data input and examples. The theory is clearly explained to those well versed in consolidation. The description of data input was adequate. The examples were the most complete of any.

Program features. Along with consolidation settlement calculations, the several programs had other features worth noting. These are discussed below.

VSTRESS3 performed both ultimate and time-rate of consolidation calculations. Time-rate calculations used Terzaghi one-dimensional consolidation theory, which requires

- saturated, homogeneous soil,
- one-dimensional compression,
- incompressible soil particles,
- Darcy's law must be obeyed, and
- soil properties remain constant during consolidation.

VSTRESS3 also came with good screen graphics to see patterns of stress distribution and settlement. The graphics may only be printed from a screen dump.

The program could handle up to 40 different rectangular surface loads, which (once specified) can be shifted to different locations for sensitivity studies. There can be 30 soil layers in a given profile. A feature unique to VSTRESS3 and TCON (compared to the others in this report) is that any shape stress/strain or stress/void ratio curve could be input - the program calculates C_c and C_r, allowing it to calculate normal- and overconsolidated soils. VSTRESS3 can use either Boussinesq or Westergaard theory to calculate stresses, at the user's direction.

SETTL/G also uses elastic theory. The program can accept up to 200 rectangular loaded areas, each producing an elastic stress calculated by Boussinesq, Westergaard, Mindlin or below-grade Westergaard theory. Loaded areas are input in cartesian coordinates. The soil compressibility is input as points on any of several curve types - slope of stress/strain, slope of log stress/change in sample height, or the actual points on a stress/deformation curve. The program has no provision for calculating time-rate of settlement.

SETTL/G has more sophisticated graphics than other programs - probably because it licensed the graphics from a vendor specializing in plotting. All video graphics and many plotter/printers are supported and easily installed from menus.

GEOTEK can perform total settlement and time-rate of consolidation calculations. It can use Boussinesq elastic theory in calculating the stresses induced by a load, or can use any arbitrary stress distribution specified by the user. The default is Boussinesq. Although the manual does not specify the number of rectangular loads the program can accommodate, it appears that a large number is available. The ultimate settlement part of the program requires the user to input C_c and C_r. The settlement calculation is then carried out stepwise for each layer. The user is allowed to input the appropriate compression index for each layer, and to subdivide layers. Settlements can be calculated at any location in the soil.

Time-rate of settlement is calculated with Terzaghi theory invoking the assumptions listed above. GEOTEK allows the user to specify initial excess pore water pressures at the boundaries. The user must supply the coefficient of consolidation, c_v. The program outputs the excess pore water pressures at user specified depth, at user specified time increments. This is useful when consolidations less than 100% are desired. The percent consolidation is then presented. The results may be displayed numerically or as a plot of excess pore water pressures versus depth. The user may interactively specify times for several plots.

PROGRS-1 calculates time-rate of settlement. It also uses Terzaghi theory. The program accepts initial pore water pressure conditions, and can use output of one run of the program as input to the next run, should the effects of later loading be desired. The boundary conditions are specified by the coefficient of permeability of the adjacent layer. Field loading (and unloading) can be specified for one semi-infinite area only. However, almost any load-time history can be input, which is useful for modeling construction processes. The program runs until a user specified time or percent consolidation is reached. The output includes the settlement at desired times, and the corresponding pore pressures.

PROGRS-1 comes with the Geocomp graphics package. This package allows the user to address many printers and color plotters.

TCON is the most versatile and complex program. TCON allows radial drainage, virtually any shape load (not limited to rectangular prisms) and does not use Terzaghi consolidation theory. Rather, it uses a finite difference procedure to solve the same consolidation equation. TCON uses Boussinesq theory to calculate stress distributions. The program may be stopped at any of the following stages of execution

1. computation of stresses,
2. computation of ultimate settlement, or
3. computation of time-rate of settlement.

TCON also requires the most complex data. Besides the usual input associated with one-dimensional consolidation theory, the coefficient of volume compressibility, m_v, the coefficient of consolidation in the radial direction, the coefficient of permeability in the radial direction, and C_s, the coefficient of swelling are also required. TCON can apply loads in increments, to simulate construction.

All of the programs can accept loads that are embedded in the ground (buildings with basements, for example).

Vendor support evaluation. All of the vendors neglect to provide adequate technical support for their respective products. The Geocomp manual promises phone support, but the author had great difficulty getting adequate technical assistance. Geosoft has similar poor support - a telephone answering machine, sometimes manned. VSTRESS3 has only written support, no telephone, while GEOTEK has telephone support from Professor Al-Khafaji, Civil Engineering Department, Bradley University. This support is limited. TCON offers occasional telephone support, with a continuous answering machine.

Features common to all programs. All the programs have the following characteristics:

- could use math co-processors (Intel 8087 or 80287),
- speed was sufficient,
- will run on IBM PCs and compatibles, such as the one used by the Alabama Highway Department Bureau of Materials and Tests,
- no source code available to the user, and
- available in 5.25 inch disks.

Summary.

The programs were ranked in the following order of desirability:

VSTRESS3 from Acumen Software
TCON from Design Professionals Management Systems
GEOTEK from Professor Al-Khafaji, Civil Engineering Department, Bradley University.
SETTL/G from Geosoft
PROGRS-1 from Geocomp

VSTRESS3 offers the user the easiest to use, widely flexible program. TCON, while more flexible, was considerably more difficult to use, and came with a disclaimer indicating a few minor bugs still existed in the program. GEOTEK offers the user a mediocre program, but comes with a host of other geotechnical engineering programs which may be helpful to some users (including consolidation laboratory data reduction). SETTL/G, while easy to use, does not compute time-rate of settlement. PROGRS-1 was very difficult to understand and use. Cost was not used as a criterion, since the initial cost will be amortized over a long period of time.

VSTRESS3 is the primary choice.

Acknowledgments.

This project was funded by the Alabama Highway Research Center, Dr. Frazier Parker, Director. The assistance of Keith Maxwell in compiling the list of computer programs and obtaining copies of the consolidation programs is gratefully acknowledged.

Appendix A.

Sources of information and categorized list of geotechnical computer programs (1988)

SOURCES OF INFORMATION

ASCE *Civil Engineering* magazine
ASCE *Civil Engineering News*
Geotechnical News
Transportation Research News
Geotechnique
Canadian Geotechnical Journal
National Information Service Earthquake Engineering
Manufacturers literature

COMPUTER PROGRAMS

CONSOLIDATION PROGRAMS

VSTRESS3 $965 (Demo-$15)

Acumen Software Products
P.O. Box 23171
Harahan, LA 70123

Vertical stress induction & consolidation settlement analysis allowing any load to be modeled by simple coordinate description of the boundaries of component regions. Hardware Requirements: 256K; standard graphics; enhanced by color monitor and coprocessor.

FEADAM $400

Design Professionals Management Systems (DPMS)
401 Parkplace Suite 220 P.O. Box 2364
Kirkland, WA 98083
(206) 822-2872

Finite element analysis of dams. Analyzes stresses and deformations in the incremental construction of an earth embankment. Hardware Requirements: 192K;Dos 2.1 or later; coprocessor; 2 disk drives recommended; 132 column printer; graphics monitor.

Geotechnical Engineering Package $2695

Design Professionals Management Systems (DPMS)
401 Parkplace/Suite 220/ P.O. Box 2364
Kirkland, WA 98083
(206) 822-2872

Includes:STABL, WEAP, FEADAM, SSTIPN (Soil/Structure Interaction Program), COM624 (Lateral pile analysis), SETTLE (1-D consolidation/settlement), INCLINE (Inclinometer data reduction, analysis, and plotting),USGS (Groundwater model).

TCON $600,$1000,$1500 (TCON Jr.,TCON,TCON +)

Design Professionals Management Systems (DPMS)
401 Parkplace Suite 220 P.O. Box 2364
Kirkland, WA 98083
(206) 822-2872
Computes settlements due to consolidation of soils under various types of loadings. Hardware Requirements: Coprocessor;512K or 320K for Jr.;132 column printer;optional pen plotter.

SETTLE $350

Engineering Software Services, Inc.
901 Douglas Avenue/Suite 206
Altamonte Springs, FL 32714
(305) 862-7755
Foundation settlement program using Schmertmann's Method.

APILE2 $150 ($200 w/graphics)

ENSOFT, Inc. Engineering Software
P.O. Box 180348
Austin, TX 78718
(512) 458-1128
Makes an estimate of the load-settlement curve in the design of pile foundations utilizing the T-Z method for pile-soil-interaction analysis. Hardware Requirements: 256K; Dos 2.1 or later; Coprocessor.

FEECON $800

GEOCOMP Corp.
342 Sudbury Road
Concord, MA 01742
(617) 369-8304
Solves 2-D, plane strain, stress-deformation problems in soils. Hardware Requirements: 512K; Hard disk, coprocessor, and graphics card recommended.

PROGRS $350

GEOCOMP Corp.
342 Sudbury Road
Concord, MA 01742
(617) 369-8304
Solves the one-dimensional consolidation problem for a multi-layered compressible stratum. Options: Plotting ($300). Hardware Requirements: 256K; Hard disk, coprocessor, and graphics card recommended.

COM624/G $490

Geosoft
1442 Lincoln Ave., Suite 146
Orange, CA 92665
(714) 998-4030

Developed at University of Texas, Austin as COM624. Analyzes stresses and deflections for laterally loaded piles with internal generation of p-y curves. Primarily recommended for offshore application.

PILED/G $490

Geosoft
1442 Lincoln Ave., Suite 146
Orange, CA 92665
(714) 998-4030

Solves for deflection and bending moment along a pile under lateral loads as a function of depth. Generates p-y curves internally for response predictions. Hardware Requirements: graphics card and monitor; coprocessor recommended.

SETTL/G $490

Geosoft
1442 Lincoln Ave., Suite 146
Orange, CA 92665
(714) 998-4030

One-dimensional consolidation program which performs settlement and stress distribution calculations under uniformly loaded rectangular areas. Hardware Requirements: graphics; coprocessor recommended.

micro-FLUSH $1400 plus Univ. Discount

Geotechnical Research, Inc.
2400 Old Crow Canyon Road, Suite B-H
San Ramon, CA 94583
(415) 837-2350

1-D site response, 2-D finite element analysis, graphics. Microcomputer implementation of FLUSH (main-frame) developed by University of California Berkeley. Hardware Requirements: 256K; 2 floppy drives.

GEOTEK $249.95 (Univ.-$49.95)

Prof. A. Al-Khafaji
Civil Engineering Department
Bradley University
Peoria, IL

Report generator, lab tests, stress distribution, foundation analysis and design, graphics. Hardware Requirements: 256K; graphics card and monitor

CONSOL $510

Mine Geotechnique, Inc.
306 Everglade Drive
Madison, WI 53717
(608) 833-3066
Solves for both total and time rate of consolidation settlement for 1-D layered systems.

DAM $710

Mine Geotechnique, Inc.
306 Everglade Drive
Madison, WI 53717
(608) 833-3066
Finite element program for 2-D, plane strain analysis of earth and rockfill dams and slopes. Calculates stresses, strains, and displacements due to incremental embankment construction and/or load application.

EXCAVATE $710

Mine Geotechnique, Inc.
306 Everglade Drive
Madison, WI 53717
(608) 833-3066
Calculates the stresses and movements of excavation support systems during incremental excavation of soil for large foundation construction. Hardware Requirements: Coprocessor, hard drive.

SETTLE $510

Mine Geotechnique, Inc.
306 Everglade Drive
Madison, WI 53717
(608) 833-3066
Predicts the settlement of shallow foundations placed on sand.

STRESS $510

Mine Geotechnique, Inc.
306 Everglade Drive
Madison, WI 53717
(608) 833-3066
Calculates stresses, strains, and displacements in elastic soil masses due to surcharge, foundation, and traffic loads of various shapes, sizes, and intensities.

GEOTEK-LAB & GEOTEK-PRO GEOTEK-LAB $35

National Laboratories, Inc.
Rivercity One, 3210 Claremont Ave.
Evansville, Indiana 47712
(812) 422-4119
Lab Data Reduction and Stress Distribution.GEOTEK-LAB for student work,GEOTEK-PRO for professional organizations.

CONESET $150

Thomas F. Blake
759 Paseo Montecito
Newbury Park, CA 91320
Estimation of foundation settlement using Schmertmann's CPT sand and clay methods. Hardware Requirements: 256K; 1 disk drive

FLOW PROGRAMS

Geotechnical Engineering Package $2695

Design Professionals Management Systems (DPMS)
401 Parkplace/Suite 220/ P.O. Box 2364
Kirkland, WA 98083
(206) 822-2872
Includes:STABL, WEAP, FEADAM, SSTIPN (Soil/Structure Interaction Program), COM624 (Lateral pile analysis), SETTLE (1-D consolidation/settlement), INCLINE (Inclinometer data reduction, analysis, and plotting),USGS (Groundwater model).

PC-SEEP

GEO-SLOPE Programming Ltd.
7927 Silver Springs Road N.W.
Calgary, Alberta, Canada T3B 4K4
(403) 247-2633
Finite element package used to model the movement of water through porous materials such as soil and rock. Options: Prompted Data Input - $450; Dot Matrix Plotting - $325.
$1075

SEEP/G $490

Geosoft
1442 Lincoln Ave., Suite 146
Orange, CA 92665
(714) 998-4030
Used for 2-D seepage through a planar or axisymmetric porous region. Can solve problems of flow around sheetpile walls, wells, toe drains, cut-off walls, etc.

LABORATORY DATA REDUCTION PROGRAMS

Geotechnical Engineering Package $2695

Design Professionals Management Systems (DPMS)
401 Parkplace/Suite 220/ P.O. Box 2364
Kirkland, WA 98083
(206) 822-2872
Includes:STABL, WEAP, FEADAM, SSTIPN (Soil/Structure Interaction Program), COM624 (Lateral pile analysis), SETTLE (1-D consolidation/settlement), INCLINE (Inclinometer data reduction, analysis, and plotting),USGS (Groundwater model).

ESELog & ESEBase $995 and $1495

ESE Software Ltd.
14535-118 Avenue
Edmonton, Alberta, Canada T5L 2M7
(403) 454-5411
Bore hole log & info system with database

GEOCONS, GEO-DS, GEOTRIAX, GEO-UC $350, $250, $350, $150

GEOCOMP Corp.
342 Sudbury Road
Concord, MA 01742
(617) 369-8304
Interactive programs to manipulate data from mat. property tests. Hardware Requirements:128K;one disk drive;graphics card for graphics option.

GEOLOG 3 $1500 ?

GEOCOMP Corp.
342 Sudbury Road
Concord, MA 01742
(617) 369-8304
Automates data acquisition, reduction, and plotting for remote gathering of data.

GLDMS $?

GEOCOMP Corp.
342 Sudbury Road
Concord, MA 01742
(617) 369-8304
Geotechnical Laboratory Data Management System for managing information related to testing of soils in a geotechnical laboratory. Options: Expanded System and Plotting. Hardware Requirements: 256K;Hard disk and graphics card recommended.

R/COMPACT $350

Geosoft
1442 Lincoln Ave., Suite 146
Orange, CA 92665
(714) 998-4030
Reduces and plots data from the compaction test. Follows ASTM D1557-78 and D698-78.

R/CONSOL $450

Geosoft
1442 Lincoln Ave., Suite 146
Orange, CA 92665
(714) 998-4030
Reduces and plots data from the consolidation test. Follows ASTM D2435-08.

R/D-SHEAR $450

Geosoft
1442 Lincoln Ave., Suite 146
Orange, CA 92665
(714) 998-4030
Reduces and plots data from the direct shear test. Follows ASTM D3080-72.

R/GRAIN $450

Geosoft
1442 Lincoln Ave., Suite 146
Orange, CA 92665
(714) 998-4030
Lab Data Reduction program which reduces and plots grain-size data from the sieve analysis and/or hydrometer test using ASTM D422-63 and D2487-83.

R/LIMITS $350

Geosoft
1442 Lincoln Ave., Suite 146
Orange, CA 92665
(714) 998-4030
Reduces and plots data from the Atterberg limits test. Follows ASTM D4318-84 and D2487-83.

R/U-COMP $350

Geosoft
1442 Lincoln Ave., Suite 146
Orange, CA 92665
(714) 998-4030
Reduces and plots data from the unconfined compression test. Follows ASTM D2166-85.

GEOTEK $249.95 (Univ.-$49.95)

Prof. A. Al-Khafaji
Civil Engineering Department
Bradley University
Peoria, IL
Report generator, lab tests, stress distribution, foundation analysis and design, graphics.
Hardware Requirements: 256K; graphics card and monitor

GEOTEK-LAB & GEOTEK-PRO GEOTEK-LAB $35

National Laboratories, Inc.
Rivercity One, 3210 Claremont Ave.
Evansville, Indiana 47712
(812) 422-4119
Lab Data Reduction and Stress Distribution.GEOTEK-LAB for student work,GEOTEK-PRO for professional organizations.

Aggregate Blend Software $100

Structural Behavior Engineering Laboratories, Inc.
P.O. Box 23167
Phoenix, AZ 85063
(602) 272-0274
For blending aggregates to meet a within-limits grading specification. For minus 1.5 inch size, automatic F.M. computation, graphics.

CBR $495 ($400 University version)

Von Gunten Engineering/Software, Inc.
P.O. Box 8813
Ft. Collins, CO 80525
(303) 223-8788
Calculates the results of the California Bearing Ratio test, and drafts high resolution reports and curves. Hardware Requirements: 128K; graphics card; 2 floppy drives recommended.

CPR $595

Von Gunten Engineering/Software, Inc.
P.O. Box 8813
Ft. Collins, CO 80525
(303) 223-8788
CPR is for the preparation of documentation of concrete mix performance. Hardware Requirements: 256K; graphics card; 2 floppy drives recommended.

GRN-SIZE $495

Von Gunten Engineering/Software, Inc.
P.O. Box 8813
Ft. Collins, CO 80525
(303) 223-8788
Calculates the percent passing various sieve sizes, performs ASTM D422 Hydrometer test calculations, and drafts the GSD curve. Hardware Requirements: 192K; graphics card; 2 floppy drives recommended; supports HP LaserJet.

LOGDRAFT 2.0 $995 (30-day free evaluation)

Von Gunten Engineering/Software, Inc.
P.O. Box 8813
Ft. Collins, CO 80525
(303) 223-8788
Completely computerize the preparation of boring logs. Excellent graphics capabilities. Hardware Requirements: 256K; graphics card; 2 floppy drives recommended.

PROCTOR $395

Von Gunten Engineering/Software, Inc.
P.O. Box 8813
Ft. Collins, CO 80525
(303) 223-8788
Calculates the maximum density and OMC and graphs the curve of a Proctor test. Hardware Requirements: 128K; graphics card; 2 floppy drives recommended; supports HP LaserJet.

SHEAR $695

Von Gunten Engineering/Software, Inc.
P.O. Box 8813
Ft. Collins, CO 80525
(303) 223-8788
Performs calculations and drafting for UC, DS, and Triaxial Shear tests. Graphs of Pore pressure vs. Strain and the total and effective stress paths are provided. Hardware Requirements: 256K; graphics card; Hard drive recommended; supports HP LaserJet.

RETAINING WALL PROGRAMS

RWALL

Civil Engineering Shareware $35
P.O. Box 472
Lee's Summit, MO 64063

Retaining wall analysis and design program including calculation of wall stability, optimum concrete dimensions and reinforcement.

RETWALL $290

CIVILSOFT
1592 N. Batavia Street, Suite 1A
Orange, CA 92667
(714) 974-1864
Retaining Wall Analysis

BMCOL/G $490

Geosoft
1442 Lincoln Ave., Suite 146
Orange, CA 92665
(714) 998-4030
Geosoft version of University of Texas, Austin, program. Solves problems involving linearly elastic beam columns with continuous or freely discontinuous transverse and angular loads and restraints. Useful for problems concerning wheel loads on pavement, retaining walls, sheetpile walls, pile foundation analysis, etc.

SEEP/G $490

Geosoft
1442 Lincoln Ave., Suite 146
Orange, CA 92665
(714) 998-4030
Used for 2-D seepage through a planar or axisymmetric porous region. Can solve problems of flow around sheetpile walls, wells, toe drains, cut-off walls, etc.

GEOTEK $249.95 (Univ.-$49.95)

Prof. A. Al-Khafaji
Civil Engineering Department
Bradley University
Peoria, IL
Report generator, lab tests, stress distribution, foundation analysis and design, graphics. Hardware Requirements: 256K; graphics card and monitor

TPILE $1000

TAGA Engineering Software Services
2400 Old Crow Canyon Road/Suite B-H
San Ramon, CA 94583
(415) 644-2454
Special purpose finite element program for the analysis of laterally and axially loaded piles and piers; can also be used for analysis of braced and tied-back walls.

PILE PROGRAMS

Geotechnical Engineering Package $2695

Design Professionals Management Systems (DPMS)
401 Parkplace/Suite 220/ P.O. Box 2364
Kirkland, WA 98083
(206) 822-2872
Includes:STABL, WEAP, FEADAM, SSTIPN (Soil/Structure Interaction Program), COM624 (Lateral pile analysis), SETTLE (1-D consolidation/settlement), INCLINE (Inclinometer data reduction, analysis, and plotting),USGS (Groundwater model).

WEAP2 $400

Design Professionals Management Systems (DPMS)
401 Parkplace Suite 220 P.O. Box 2364
Kirkland, WA 98083
(206) 822-2872
High speed program for the analysis of the dynamics of driven pilings and an implementation of the WEAP program written by Global Associates for the FHWA. Hardware Requirements: 256K; Dos 2.1 or later; coprocessor; 2 disk drives recommended; 132 column printer.

PGROUP $150

Engineering Software Services, Inc.
901 Douglas Avenue/Suite 206
Altamonte Springs, FL 32714
(305) 862-7755
Determines pile loads eccentricity loaded pile caps, and optimizes the spacing of piles.

APILE1 $300 ($350 w/graphics)

ENSOFT, Inc. Engineering Software
P.O. Box 180348
Austin, TX 78718
(512) 458-1128
Computes the axial capacity as a function of depth of a driven pile in clay, sand, and in mixed soil profiles using the American Petroleum Institute methods and Lambda methods. Hardware Requirements: 256K; Dos 2.1 or later; Coprocessor.

APILE2 $150 ($200 w/graphics)

ENSOFT, Inc. Engineering Software
P.O. Box 180348
Austin, TX 78718
(512) 458-1128
Makes an estimate of the load-settlement curve in the design of pile foundations utilizing the T-Z method for pile-soil-interaction analysis. Hardware Requirements: 256K; Dos 2.1 or later; Coprocessor.

GROUP1 $400 ($500 w/graphics)

ENSOFT, Inc. Engineering Software
P.O. Box 180348
Austin, TX 78718
(512) 458-1128
Computes the distribution of loads to piles in a group where the piles are installed vertically or on a batter. Hardware Requirements: 256K; Dos 2.1 or later; Coprocessor.

LPILE1 & LPILE2 $350, $450

ENSOFT, Inc. Engineering Software
P.O. Box 180348
Austin, TX 78718
(512) 458-1128
Analysis of a pile under lateral loading to obtain deflection, shear, bending moment, and soil response with respect to depth. LPILE2 offers extensive graphic capabilities. Hardware Requirements: 256K; Dos 2.1 or later; Coprocessor.

STIFF1 $200 ($250 w/graphics)

ENSOFT, Inc. Engineering Software
P.O. Box 180348
Austin, TX 78718
(512) 458-1128
Analysis of piles under lateral loading using a load factor approach. Also used to obtain bending stiffness as a function of applied moment and the ultimate bending moment. Hardware Requirements: 256K; DOS 2.1 or later; Coprocessor.

BMCOL/G $490

Geosoft
1442 Lincoln Ave., Suite 146
Orange, CA 92665
(714) 998-4030

Geosoft version of University of Texas, Austin, program. Solves problems involving linearly elastic beam columns with continuous or freely discontinuous transverse and angular loads and restraints. Useful for problems concerning wheel loads on pavement, retaining walls, sheetpile walls, pile foundation analysis, etc.

COM624/G $490

Geosoft
1442 Lincoln Ave., Suite 146
Orange, CA 92665
(714) 998-4030

Developed at University of Texas, Austin, as COM624. Analyzes stresses and deflections for laterally loaded piles with internal generation of p-y curves. Primarily recommended for off-shore application.

PILED/G $490

Geosoft
1442 Lincoln Ave., Suite 146
Orange, CA 92665
(714) 998-4030

Solves for deflection and bending moment along a pile under lateral loads as a function of depth. Generates p-y curves internally for response predictions. Hardware Requirements: graphics card and monitor; coprocessor recommended.

SEEP/G $490

Geosoft
1442 Lincoln Ave., Suite 146
Orange, CA 92665
(714) 998-4030

Used for 2-D seepage through a planar or axisymmetric porous region. Can solve problems of flow around sheetpile walls, wells, toe drains, cut-off walls, etc.

WEAP/G $390

Geosoft
1442 Lincoln Ave., Suite 146
Orange, CA 92665
(714) 998-4030

Geosoft version of FHWA program to solve the pile driveability problem. Hardware Requirements: graphics; coprocessor recommended.

GEOTEK $249.95 (University $49.95)

Prof. A. Al-Khafaji
Civil Engineering Department
Bradley University
Peoria, IL
Report generator, lab tests, stress distribution, foundation analysis and design, graphics.
Hardware Requirements: 256K; graphics card and monitor

LATPILE $510

Mine Geotechnique, Inc.
306 Everglade Drive
Madison, WI 53717
(608) 833-3066
Calculates the allowable lateral load for a given deflection and rotation for a given pile, for the rigid or flexible case.

TPILE $1000

TAGA Engineering Software Services
2400 Old Crow Canyon Road/Suite B-H
San Ramon, CA 94583
(415) 644-2454
Special purpose finite element program for the analysis of laterally and axially loaded piles and piers; can also be used for analysis of braced and tied-back walls.

SLOPE STABILITY PROGRAMS

STABL Ver. 4 - Purdue University $790

Applied Software Technologies, Inc.
P.O. Box 54766
Atlanta, GA 30308-9990
(404) 892-1339
General solution of slope stability problems. This program is incorporated in various other programs.

STABR - University of California at Berkeley $390

Applied Software Technologies, Inc.
P.O. Box 54766
Atlanta, GA 30308-9990
(404) 892-1339
General solution of slope stability problems. This program is incorporated in various other programs.

STABL5 $35

Civil Engineering Shareware
P.O. Box 472
Lee's Summit, MO 64063

Updated version of STABL from Purdue University. General slope stability program. Will now analyze tie-backs in slopes.

SLOPE $365 (w/manual)

CIVILSOFT
1592 N. Batavia Street, Suite 1A
Orange, CA 92667
(714) 974-1864
Slope stability of an earth embankment against sliding.

Geotechnical Engineering Package $2695

Design Professionals Management Systems (DPMS)
401 Parkplace/Suite 220/ P.O. Box 2364
Kirkland, WA 98083
(206) 822-2872
Includes:STABL, WEAP, FEADAM, SSTIPN (Soil/Structure Interaction Program), COM624 (Lateral pile analysis), SETTLE (1-D consolidation/settlement), INCLINE (Inclinometer data reduction, analysis, and plotting),USGS (Groundwater model).

STABL4 $400 +

Design Professionals Management Systems (DPMS)
401 Parkplace Suite 220 P.O. Box 2364
Kirkland, WA 98083
(206) 822-2872
Limit equilibrium slope stability program adapted from STABL by Ron Siegel. The program analyzes failure modes with search routines, handling anisotropic soil and a variety of groundwater conditions. Hardware Requirements: 256K;132 column printer;Dos 2.1 or later;8087 or 80287 coprocessor;2 disk drives recommended.

ISSAP $225

Engineering Software Services, Inc.
901 Douglas Avenue/Suite 206
Altamonte Springs, FL 32714
(305) 862-7755
Interactive slope stability analysis package for evaluating natural or man-made slopes using the modified Bishop method.

PC-SLOPE

GEO-SLOPE Programming Ltd.
7927 Silver Springs Road N.W.
Calgary, Alberta, Canada T3B 4K4
(403) 247-2633
Solves for F.S. of earth and rock slopes of various shaped slip surfaces. Options: Prompted Data Input - $450; Dot Matrix Plotting - $325.
$875 (Less 30% Educ. Discount)

GEOSLOPE $450

GEOCOMP Corp.
342 Sudbury Road
Concord, MA 01742
(617) 369-8304
Performs soil slope stability analysis. Plotting option available. Based on STABL from Purdue University. Hardware Requirements:320K;one disk drive;graphics card for graphics option;co-processor recommended.

SWARS $800

GEOCOMP Corp.
342 Sudbury Road
Concord, MA 01742
(617) 369-8304
Factor of Safety for rock slopes and excavations. Hardware Requirements:256K;one disk drive;co-processor supported.

SLOP8R/G $390

Geosoft
1442 Lincoln Ave., Suite 146
Orange, CA 92665
(714) 998-4030
Slope stability analysis. Geosoft version of University of California, Berkeley, program. Computes F.S. for specified circular or non-circular slip surfaces.

STABR/G $390

Geosoft
1442 Lincoln Ave., Suite 146
Orange, CA 92665
(714) 998-4030
Slope stability analysis. Geosoft version of University of California, Berkeley, program STABR. Computes F.S. for specified circles or searches for circular slip surfaces having minimum F.S.

Slope Stability Program (ASCE Civil Engineering, Oct.,1982)

John P. Cross
STS Consultants
Northbrook, Illinois

Slope Stability
Free

DAM $710

Mine Geotechnique, Inc.
306 Everglade Drive
Madison, WI 53717
(608) 833-3066
Finite element program for 2-D, plane strain analysis of earth and rockfill dams and slopes. Calculates stresses, strains, and displacements due to incremental embankment construction and/or load application.

SEARCH $510

Mine Geotechnique, Inc.
306 Everglade Drive
Madison, WI 53717
(608) 833-3066
Slope stability program. Searches for the most critical non-circular or circular shear surface.

SLIDE $510

Mine Geotechnique, Inc.
306 Everglade Drive
Madison, WI 53717
(608) 833-3066
Slope stability program. Analyzes the sliding stability of gravity dams and concrete structures, and can accommodate sloping backfill, irregular soil boundaries, seepage pressures, uplift forces, single and multiple plane options for the failure surfaces.

SLOPE $510

Mine Geotechnique, Inc.
306 Everglade Drive
Madison, WI 53717
(608) 833-3066
Slope stability program. Calculates the factors of safety for specified circles, or searches for the most critical circular slip surface having the minimum factor of safety.

SPENCE $510

Mine Geotechnique, Inc.
306 Everglade Drive
Madison, WI 53717
(608) 833-3066
Slope stability program. Calculates the factor of safety for specified non-circular slip surfaces.

TSTAB $600

TAGA Engineering Software Services
2400 Old Crow Canyon Road/Suite B-H
San Ramon, CA 94583
(415) 644-2454
Limit equilibrium slope stability analysis with optional search for critical circle. Hardware Requirements: 256K; coprocessor recommended.

SB-SLOPE $595 ($400 University version)

Von Gunten Engineering/Software, Inc.
P.O. Box 8813
Ft. Collins, CO 80525
(303) 223-8788
Calculates slope stability by simplified Bishop Method and uses graphics for data checking, selection of failure surfaces, and outputting results. Hardware Requirements: 192K; graphics card; 2 floppy drives recommended.

ZSOIL PC $900

ZEI Software Development
5111 Leesburg Pike Suite 703
Falls Church, VA 22003
(703) 820-4848
Slope stability and bearing capacity for generalized structures using the plasticity theory. Provides surface of failure using graphics and data preparation module. Hardware Requirements: PC-AT w/286 processor; 640K; coprocessor; graphics.

DATABASE PROGRAMS

ESELog & ESEBase $995 and $1495

ESE Software Ltd.
14535-118 Avenue
Edmonton, Alberta, Canada T5L 2M7
(403) 454-5411
Bore hole log & info system with database

GLDMS $2000

GEOCOMP Corp.
342 Sudbury Road
Concord, MA 01742
(617) 369-8304
Geotechnical Laboratory Data Management System for managing information related to testing of soils in a geotechnical laboratory. Options: Expanded System and Plotting. Hardware Requirements: 256K;Hard disk and graphics card recommended.

GEOTEK $249.95 (University $49.95)

Prof. A. Al-Khafaji
Civil Engineering Department
Bradley University
Peoria, IL
Report generator, lab tests, stress distribution, foundation analysis and design, graphics. Hardware Requirements: 256K; graphics card and monitor

MISCELLANEOUS AND MULTIPURPOSE PROGRAMS

Geotechnical Engineering Package $2695

Design Professionals Management Systems (DPMS)
401 Parkplace/Suite 220/ P.O. Box 2364
Kirkland, WA 98083
(206) 822-2872
Includes:STABL, WEAP, FEADAM, SSTIPN (Soil/Structure Interaction Program), COM624 (Lateral pile analysis), SETTLE (1-D consolidation/settlement), INCLINE (Inclinometer data reduction, analysis, and plotting),USGS (Groundwater model).

BMCOL/G $490

Geosoft
1442 Lincoln Ave., Suite 146
Orange, CA 92665
(714) 998-4030

Geosoft version of University of Texas, Austin, program. Solves problems involving linearly elastic beam columns with continuous or freely discontinuous transverse and angular loads and restraints. Useful for problems concerning wheel loads on pavement, retaining walls, sheetpile walls, pile foundation analysis, etc.

micro-FLUSH $1400 plus Univ. Discount

Geotechnical Research, Inc.
2400 Old Crow Canyon Road, Suite B-H
San Ramon, CA 94583
(415) 837-2350

1-D site response, 2-D finite element analysis, graphics. Microcomputer implementation of FLUSH (main-frame) developed by University of California, Berkeley. Hardware Requirements: 256K; 2 floppy drives.

GEOTEK $249.95 (University $49.95)

Prof. A. Al-Khafaji
Civil Engineering Department
Bradley University
Peoria, IL

Report generator, lab tests, stress distribution, foundation analysis and design, graphics. Hardware Requirements: 256K; graphics card and monitor

DAM $710

Mine Geotechnique, Inc.
306 Everglade Drive
Madison, WI 53717
(608) 833-3066

Finite element program for 2-D, plane strain analysis of earth and rockfill dams and slopes. Calculates stresses, strains, and displacements due to incremental embankment construction and/or load application.

FOOTINGS $510

Mine Geotechnique, Inc.
306 Everglade Drive
Madison, WI 53717
(608) 833-3066

Aids in the design of shallow foundations placed in sands and/or clays.

GEOTEK-LAB & GEOTEK-PRO GEOTEK-LAB $35

National Laboratories, Inc.
Rivercity One, 3210 Claremont Ave.
Evansville, Indiana 47712
(812) 422-4119
Lab Data Reduction and Stress Distribution.GEOTEK-LAB for student work,GEOTEK-PRO for professional organizations.

PC-LIQ $1000

TAGA Engineering Software Services
2400 Old Crow Canyon Road/Suite B-H
San Ramon, CA 94583
(415) 644-2454
Liquefaction potential from SPT data.

LIQUEFY2 $375 (Demo $30)

Thomas F. Blake
759 Paseo Montecito
Newbury Park, CA 91320
(805) 499-5266
Empirical analysis of earthquake-induced liquefaction potential. Hardware Requirements: 320K; graphics; coprocessor recommended.

Appendix B.

Warranties and License Agreements

OWNERSHIP AND TERMS OF SUPPORT

The computer program described in this manual is proprietary to TAGA Engineering Software Services (TAGA) and ownership of the program remains with TAGA even though use of the program may be licensed to others. Neither this Manual nor the program may be copied except as provided for in the licensing agreement. Each copy of the program that is licensed contains hidden identifiers in order that we may identify the source of any unauthorized copies.

The program is supported by TAGA under the terms of the licensing agreement or subsequent maintenance agreements. Under the terms of these agreements we will provide updates, fix bugs in the unmodified protions of the program and/or suggest alternate ways to use the program to circumvent bugs, and answer simple questions regarding use of the program by telephone or in writing. There is normally no limit to the number of such questions we are willing to answer, but should any user ask an unreasonably large number of questions, they will be so informed in writing and billed for any additional time spent by us at normal consulting rates. Problem-specific modifications of the program that are requested by users can be made by our staff at rates which will be negotiated on a case-by-case basis. In general, we cannot answer questions regarding the modelling of problems or the choice of material properties, but staff members of our associated company, Telegraph Avenue Geotechnical Associates, are available for consultation on engineering questions.

SETTL/G

SETTLEMENT AND STRESS DISTRIBUTION ANALYSIS

developed for

the IBM-PC and COMPATIBLES

by

GEOSOFT

1442 Lincoln Avenue, Suite 146

Orange, California 92665, U.S.A.

[714] 998-4030

DISCLAIMER OF WARRANTY

The software and manuals are sold 'AS IS' and without warranties as to performance or merchantability. The programs are sold without any expressed or implied warranties whatsoever. Because of the diversity of hardware and conditions under which these programs can be used, no warranty of suitability for a particular purpose is offered. The user must assume the entire risk of using the programs, and is advised to test them thoroughly and use appropriate engineering judgment in interpreting the results. Any liability of GEOSOFT will be limited exclusively to product replacement or refund of the purchase price.

PROGRS

Version 3

LIMITED WARRANTY

GEOCOMP Corporation (GEOCOMP) warrants that this product will perform in accordance with the product documentation enclosed. GEOCOMP's only obligation shall be to replace defective media and correct operational errors so that the product performs as stated in the product documentation.

GEOCOMP's entire liability and Purchaser's sole exclusive remedy for any violation of or default in performance of any term or condition of this agreement by GEOCOMP shall be as follows:

A defective diskette returned to GEOCOMP within 30 days from the date of purchase will be replaced at no charge. A defective diskette returned after 30 days from the date of purchase will be replaced at a cost of $40. This warranty does not include replacement for damage to the diskette resulting from accident, disaster, misuse, abuse, or non-GEOCOMP modification of this product.

If GEOCOMP is unable to provide the product as warranted herein, the Purchaser shall be entitled to a refund of the amount paid for the product. A refund will be delivered upon receipt by GEOCOMP of all of the following: all diskettes and user's manuals provided by GEOCOMP to the Purchaser, a written description of why the Purchaser is claiming a refund, and a signed statement that all copies of the software and user's manual, in whole or in part, have been destroyed and that the Purchaser has complied fully with the terms of this License Agreement.

GEOCOMP'S liability for damages to the Purchaser for any cause whatsoever shall be limited to the amount the Purchaser paid for the product. GEOCOMP will not be responsible for any damages caused by the Purchaser's failure to perform any responsibility of the Purchaser described herein, or for any lost benefits or other consequential damages even if GEOCOMP has been advised of the possibility of such damages, or for any liability of the Purchaser to any third party.

This agreement will be performed by GEOCOMP Corporation and shall be interpreted in accordance with the laws of the Commonwealth of Massachusetts.

Acumen Software Products
P.O.Box 23171
Harahan, LA 70123

March 15, 1988

Dear Colleague:

Enclosed are a demonstration copy of VSTRESS3 and a disk file version of the user's guide. This MS-DOS application provides a very powerful tool with which to compute vertical stresses and the resulting consolidation settlement quickly and accurately. We would appreciate your review of this application for use by your foundations and geotechnical engineers.

VSTRESS3 uses the exact theoretical solution to the Boussinesq and Westergaard theories of elasticity. This program permits modeling of both two- and three-dimensional surface loads without tedious approximations by the user. Exact modeling provides confidence in the outcome.

VSTRESS3 automatically adjusts the stress relationship data for depth in overconsolidated soil strata. VSTRESS3 also allows for stratified soils - combinations of consolidating and non-consolidating material to include normally-, over- and under-consolidated clays.

VSTRESS3 has built-in tools with which to inspect, review and modify models and to store and retrieve them from files. File storage permits the separate capturing of the load models and soil models to permit mixing for "what-if's".

VSTRESS3 offers several formats of both printed and graphic output including the graphic display of the stress intensity bulbs.

Because VSTRESS3 is general, even the most tedious and awkward cases can be easily executed. This provides substantial savings in the time spent in computing settlement. Additionally, the ease of use and precision of the program permits fine-tuning of the models to eliminate over-construction caused by lack of confidence in approximated models.

ACUMEN offers both site licenses and multiple-copy discounts. The single copy price is $965.00. ACUMEN is also available for customization at very reasonable rates.

Thank you for your attention.

Sincerely,

Michael E. Pittman, PhD
Acumen Software Products